Space Weather Technical Forecast

Issued on Friday, 01 March 2024 at 01:21 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Ongoing risk of M or X-Class flares from AR3590 in the northwest.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Low during the last 24 hours, with the largest event a C6 peaking at 29/0000 UTC from AR3590. There are seven sunspot regions on the disc. AR3590 remains the largest and most significant potential flare source, with a complex magnetic structure and large delta spot persisting within its intermediate spots. This spot also has a large amount of associated flux, increasing the potential for larger flares, although the region appears to have remained stable with little change in size and complexity over the past 24 hours. Meanwhile AR3595 has continued to develop, and is now classified as Ehi/beta-gamma. AR3598 has also developed, although slowly, and is now classified as Dai/beta. The remaining regions are smaller and simpler, either stable or decaying.

A southward directed CME from the region of AR3591 has been analysed and is not expected to be Earth directed.

Solar Wind / Geomagnetic Activity: Solar winds as recorded by ACE and DSCOVR at L1, generally varied between 380-420 km/s, with a predominantly gradually declining trend. Density was below average throughout. The interplanetary magnetic field, Bt, was weak throughout, below 5nT. The north-south component, Bz, varied weakly between +4/-4nT. Phi angle was negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was also at background levels with the associated 24 hour fluence well below the Active (1e8 integrated pfu) threshold. The observed 24-hour fluence at 01/0000UTC was 1.56e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected with isolated M-class flares likely. There remains a slight chance of X-class flares from AR3590, although through days 3 and 4 (3rd and 4th) this risk diminishes as AR3590 rotates behind the west limb.

Solar Wind / Geomagnetic Activity: There are three recent CMEs which are all most likely to miss Earth, but with a risk of some glancing influence either late tomorrow (2nd Mar), or more likely early Day 3 (3rd Mar). Solar winds may occasionally become slightly elevated in the near term, possibly due to some weak interaction with the high speed stream from CH03. Otherwise no notable solar wind enhancements are expected, with the lack of any significant coronal holes and the absence of significant CME enhancement.

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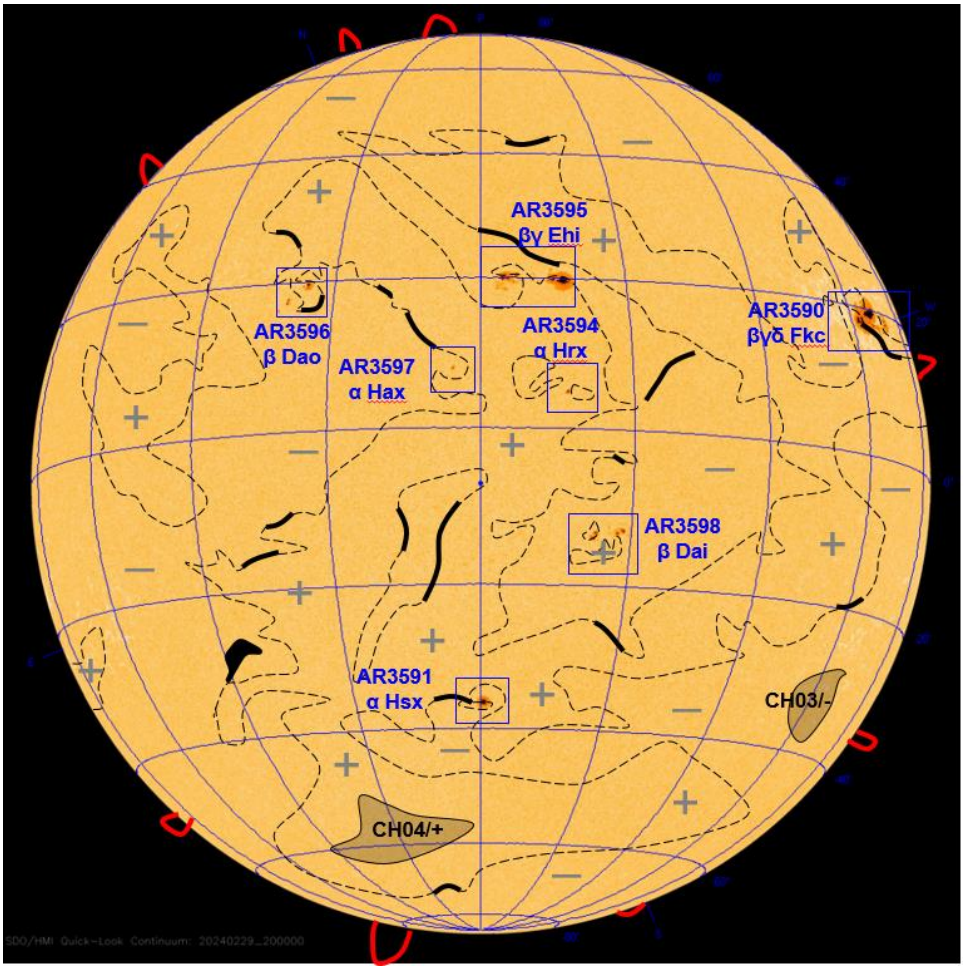
Geomagnetic activity is therefore forecast to be mostly Quiet (Kp 0-2), perhaps increasing to give Unsettled to Active (Kp 3-4) intervals with any CME influence on Days 2 and 3 (2nd and 3rd Mar), with a Slight Chance of an isolated G1 (Kp 5) Minor Geomagnetic storm interval.

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is likely to stay at background levels, but with a slight chance of rising above S1 levels in response to any notable flares from AR3590, due to its position in the western disc. GOES16 high energy electron flux is expected to remain at background levels with the associated 24hr fluence remaining well below the Active threshold throughout.

Figure 1. Solar Analysis Valid 29/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are three recent CMEs which have been considered for any Earth directed influence - one from 27 Feb and two from 28 Feb. All are thought most likely to miss Earth, but with a risk of some glancing influence either late tomorrow (2nd Mar), or more likely early Day 3 (3rd Mar). Solar winds may become slightly elevated at times due to possible, temporary weak interactions with a high speed stream from CH03/-. Otherwise the solar winds are expected to remain predominantly at background levels, with the absence of significant coronal hole influence or CME's.

Geomagnetic activity is therefore forecast to be mostly Quiet (Kp 0-2), perhaps increasing to give Unsettled to Active (Kp 3-4) intervals with any CME influence on Days 2 and 3 (2nd and 3rd Mar), with a Slight Chance of an isolated G1 (Kp 5) Minor Geomagnetic storm interval.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
27/1856	Partial	Filament	South Centre	450 km/s	02/2100 UTC	Glancing blow possible
28/1335	Partial	Filament	SE	750 km/s	02/1200 UTC	Glancing blow possible
28/1743	Partial	Uncertain	NE	460 km/s	02/1800 UTC	Glancing blow possible

Figure 2: Met Office Enlil Ensembles indicating possible CME arrivals.

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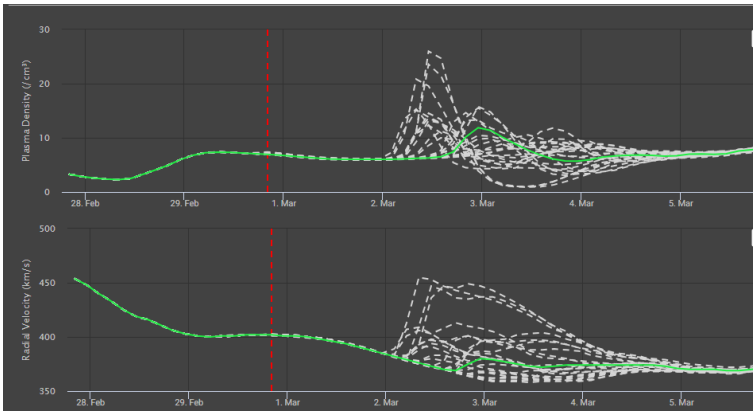

Radio Blackouts - X-Ray Flares:

There are seven sunspot regions on the disc. AR3590 remains the largest and most significant potential flare source, with a complex magnetic structure and large delta spot within its intermediate portion remaining visible despite the increasingly foreshortened view. Over the past 24 hours AR3595 has increased its latitudinal spread, becoming a more mature bipolar spot with recent small scale mixed polarity developments within the central portion. There has also recently been a slight increase in area of the penumbra on the leading spot. AR3595 is now classified as Ehi/beta-gamma. AR3598 has also continued to develop, with weak penumbra developing around the leading and trailing portions. AR3598 is now classified as Dai/beta. The remaining regions are generally smaller and simpler, and either stable or decaying.

Isolated M-class flares are considered likely, with a slight chance of X-class flares. The strongest flares are most likely to be from AR3590, although AR3590 will rotate off the disc late tomorrow (2nd Mar), with the risk of flares therefore declining thereafter. However, new active regions are expected to rotate onto the visible disc through the period, with one region arrive today.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	60	60	50	40
Very Active	R3 to R5 X Class	No	15	15	10	1

Figure 3: Latest SDO/AIA images of AR3590.

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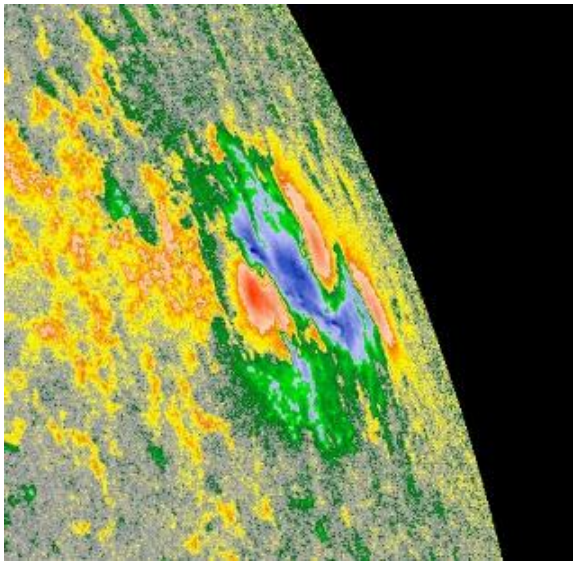

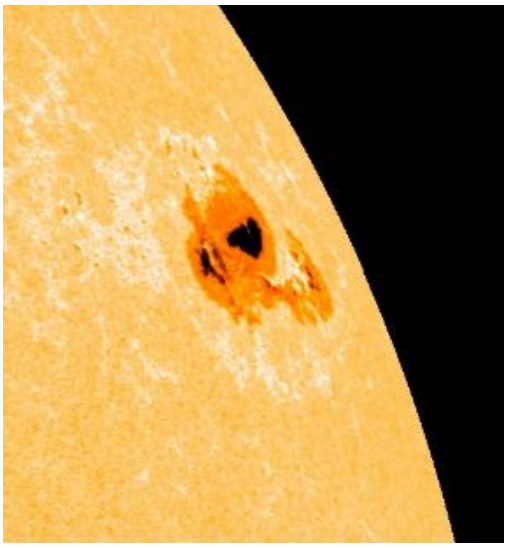

Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background levels, and is likely to remain so through this period. However, there is a slight chance of enhancement as AR3590 is approaching the northwest limb. This is low confidence however, due to the current relatively low activity from the region. Although AR3590 rotates off the disc late on Day 2 (2nd Mar), the risk of proton events remains until it is well over the west limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	15	15	10	5
Very Active	**≥ S3 ***	No	5	5	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 is currently at background levels. With the absence of significant coronal holes in the forecast, and only the potential for occasional weak connections to a high speed stream from CH03/-, little change is expected.
The associated 24 hour fluence is expected to stay well below the Active (1e8 integrated pfu) threshold. The REFM currently thought to be giving good guidance, although a forecast steady trend is preferred.

GEO Electron Environment	Level (cm^{-2} sr^{-1}	Past 24 Hours	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)

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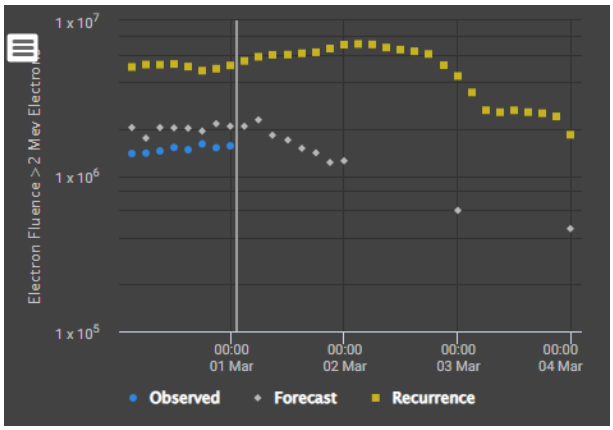
Probability (Exceedance)	day^{-1})	(Yes/No)	(%)	(%)	(%)	(%)
Active	**≥ 2 MeV ≥ 1x10^{8}**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ 1x10^{9}**	No	1	1	1	1

Figure 4: MOSWOC REFM.



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